ELECTRICAL REVIEW

[ILLUSTRATED.]

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Discussion at the Meeting of the Society of Arts, Massachusetts Institute of Technology.

The last meeting of the Society of Arts for the season was held Thursday evening, May 26, Prof. Chas. R. Cross in the chair. After the reading by the secretary of a short paper on Submarine Telegraphy, by J. N. Batchelder, the speaker of the evening was introduced, Mr. M. M. M. Slattery, of Woburn, the electrician of the Sun Electric Company. Prof. Cross, in opening, said: "It is exceedingly interesting to notice how old devices are adapted and put to new uses. When I began to teach physics there were, perhaps, two uses for the induction coil, first the electric discharge through gases, probably more valuable in scientific research than to the commercial public, and second to give shocks to our rustic friends on the common, who swarm like flies, especially on 4th of July. Next followed its employment in the chromoscope, and in telegraphy. Then it was employed in telephonic transmission, and last winter the novel and interesting application to electrical welding was shown and explained. Some years ago it was proposed to employ in electric lighting the induction coil to get over large areas. The systems did not succeed at first, and as now developed and perfected will give a new impulse to the advance of electrical distribution."

Mr. Slattery then read his paper, which was published last week.

The discussion which followed evinced the fact that the induction system was new to the audience in such a complete form. There were three converters in the room on the platform, a 20, 12, and 4 lamp coils. Mr. Slattery showed that while the 20 lamp coil had perfect regulation, as far as the eye could see, from 1 lamp up to the full load of 20 lamps, the coil was not self-regulating when used on 25 lamps, 5 more than it was intended for. To show that the current in the primary was proportional to the current in the secondary, Mr. Slattery placed a lamp in series with the primary of the 12 lamp coil, and when lamps were turned on the incandescence of this indicator lamp showed clearly the increase of current in the primary. The effect of self-induction and means for suppressing it were shown in a novel way. The secondary current (feeding lamps) of this 12 light coil was coupled in series with the primary of an induction coil, of which both the primary and secondary contained the same number of turns of coarse wire. The lamps did not give any light, as the potential in this circuit was much lowered by the counter electromotive force of the primary of the second coil, and the humming sound of the iron in this coil was heard When, however, the secondary of the second coil was closed the lamps burned at their normal brilliancy.

In response to questions Mr. Slattery said that in his system the primaries of the converters were attached to the dynamo circuit in multiple arc, also that the loss in the primary circuit, when no lamps were on in the secondary, was small, less than 2½ per cent. This could be made smaller, but with a lowering of the efficiency of the coil when working under its full load.

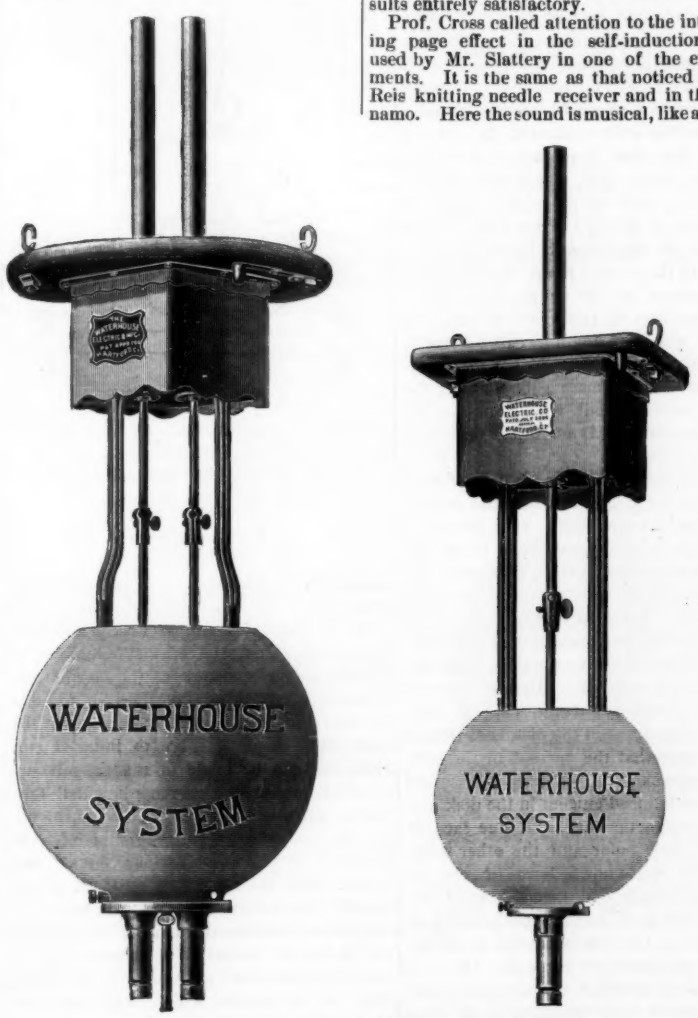
Mr. Skinner asked the percentage loss when only part of the load was on.

Ans.—There is no greater loss, as the counter E.M.F. is in direct proportion to the decrease of load.

Mr. Skinner asked if this counter E.M.F. resistance did not cause heat and loss of energy.

Ans.—The coil when working under its highest efficiency, the heating effect is less than at full load.

Ques.—What is the comparative danger from a 40 light Brush machine and a 1,000 volt alternate current dynamo?



New Arc Lamps of the Waterhouse Company.

Ans.—Comparative experiments will be made upon cranks, electrical or otherwise, as soon as a sufficient number are obtained who are willing to submit to the test. I do not believe that there is any more danger in a physiological point of view from 1,000 volts alternating current than from the same of direct current. I have taken that amount and live to tell it. It was not pleasant, but not disastrous. In fact, there is nothing more to fear than from low tension circuits, direct current. From a physiological standpoint the alternate current is safer. For at the moment of breaking the circuit of a direct current the E.M F. rises. In an alternate current circuit this does not happen, as the current is neutralized by itself.

Mr. Garratt asked, Can iron wire be used successfully in outside wiring?

Ans.—The Boston Electric Lighting Company use it in some cases, as the copper would have to be so small that the wire would sag. In this room, this evening, for 40 lamps the current is brought by a No. 18 copper wire; a No. 23 would answer just as well.

In reply to an inquiry Mr. Slattery remarked that self-induction magnets could be employed to tone the light, turning it down as readily as gas is governed, and that the apparatus for this purpose would consume less power and require less space than resistance coils for direct current systems. As to the blackening of the lamps, experiments are in progress which it is hoped will lead to results entirely satisfactory.

Prof. Cross called attention to the interesting page effect in the self-induction coil used by Mr. Slattery in one of the experiments. It is the same as that noticed in the Reis knitting needle receiver and in the dynamo. Here the sound is musical, like a horn, there being the same number of upper partials. In dynamo circuits the irregular vibration give so large a number of higher partials that the sound is unpleasant. In this case the curve is not a sinusoid, but it is regular. It would be possible to construct an electrical organ employing this principle.

Mr. Moriarty inquired if in operating the induction system in underground cables if there was any loss of economy on account of retardation. Mr. Slattery replied that experiments are now in progress to determine this. That in his opinion the loss would be very small.

Prof. Cross said that the large conductors employed in an electric light system would reduce the loss from retardation, otherwise a long line, twelve miles or so would show its effects.

The Waterhouse Lamps.

The Waterhouse Electric and Manufacturing Company, Hartford, Conn., are continually adding to their system of electric lighting.

To meet the public demand, the electrician of the company, Mr. A. G. Waterhouse, has perfected several new arc lamps; and we illustrate on this page the new form of single carbon lamp, and their new double carbon or all-night lamp.

The single carbon lamps are now being made in two styles, one with clutch feed, and the other a rack feed lamp. It is a common argument for the representative of a system having a clutch feed lamp to condemn all rack feed lamps, while the rack feed representative is equally as vociferous in his condemnation of the clutch feed. In the Waterhouse system the public can have their choice.

The same style of magnet is used in all of the Waterhouse lamps. It is a new invention, and is covered broadly by patents. The shape is quadrangular, and on the iron core are the shunt and main circuit coils, wound at right angles from each other. This produces two variable poles on the magnet. Under these poles is pivoted an armature, which is held in position by a spiral spring, when not drawn to the magnet by magnetism. Attached to the armature is the clutch lifting device, or, in the the rack feed lamp, the rack feed attachment.

Both of these mechanisms are very simple, and not liable to get out of order.

The current flowing through the main conductor produces magnetism in the variable pole, which draws up the armature and lifting device, thus forming the arc. As the carbons burn away and increase the resistance in the main by circuit separation, a portion of the current flows through the shunt, and its pole being an opposite pole from that produced by the main coil, the effect is to neutralize the magnetism, which allows the armature to lower and the carbon to feed. The feeding is very fine, as all sudden movement of the mechanism is avoided, so that the lamps are no small part of the system which is producing such a remarkably steady light in the upper part of New York city.

The lamps are convenient for trimming outside of the globe, and they have an automatic cut-out, and hand cut-out, also.

The record of double carbon lamps of all systems, thus far, has been that they take more power and do not give as steady light as single carbon lamps; but the Waterhouse double carbon lamp, it is claimed, eradicates these objections. The same magnet is used as in the single carbon lamps, and the feeding mechanism is arranged by a simple device for rack feed.

It is entirely suitable for all-night runs, thereby making a saving in cost to trim.

All of the Waterhouse lamps burn with one-eighth inch separation of carbons, and produce a white, steady light, with sunlight effect.

So steady is this light, and of such fine regulation, that the distance penetrated is very great and constant.

Arc Lamp Electricity.

"Does it affect a watch to stand near a dynamo machine when it is in motion?" was asked of the night superintendent of the Brush station on Ferdinand street.

"Oh, yes; very seriously."

"And why?"

"Because the works become charged with electricity. The steel absorbs a greater quantity of the fluid than the brass, and the resistant influence upon the latter metal by the former becomes so great that the wheels are held in check and the watch stops."

"Is it dangerous business to work about a dynamo?"

"No; we haven't had an accident here since the station was established. The line men, however, frequently get a shock, but it is seldom they receive any serious injury."

"Can you tell when a lamp goes out on a given circuit?"

"No; but if three or four should fail, those little dials upon that shelf over there would warn us of the fact."

"Are you troubled much by your lamps failing to burn?"

"No. If the rods are properly covered and the other mechanism carefully attended to, we have no difficulty. A lamp with ordinary care ought to run six months without repair. After that it should be thoroughly overhauled."

"What power does it take to run a single lamp?"

"We reckon one horse power to each lamp."

"What is this amount of power worth?"

"When we hired it we paid $100 a year; but with our machinery it costs about $45. Experts differ on this subject, however, some claiming that it costs nearly $60 to develop a horse power."

"How many lamps do you run on a circuit?"

"About 60."

"And how many circuits have you?"

"Thirty-three running from this station."

"Of course the nearer your lamps are together the cheaper it is to run them, as you have so much less wire to look after."

"Yes, that is true. But what do you think of two lamps three miles apart, as is the case on one of our circuits in the outskirts of the city? The profit on these illuminators can't be great, when the cost of the wire and the attention necessary to keep it in repair are taken into consideration."

"Why don't you put your wires under ground?"

"That we will willingly do when some one invents a properly insulated cable. You see the nature of the electric current is to reach the earth, and if the insulation is not complete it jumps from the wire, and its intensity for service beyond the defect is thereby reduced. Our company has spent $10,000 in experimenting with underground cables, but all the results have been unsatisfactory. It would cost an enormous sum to bury our wires, but it would be a good investment even at that, because we would then escape the nuisance of continually repairing them, as is now the case, and also avoid the constant complaints of people over whose buildings the wires are strung. It is a popular belief that electric lighting wires endanger property from fire, and the moment one of them is run over a house for the first time the owner immediately declares war against us, as he thinks we are plotting to cremate him. The record of fires caused by electric wires you will find to be very small. Many claim that the premium of their policies is increased when the wires are attached to their buildings. But it seems to me ridiculously absurd for an insurance company to raise its rates under such circumstances, as mice nibbling at matches cause 100 fires to our one; yet we never hear of them being taken into consideration when an insurance rate is given on a building."

"How many men do you employ here?"

"One hundred and thirty, divided into three reliefs."

"What is the combined intensity of all your dynamos?"

"Strong enough to instantly kill every person in the city of Boston, were they to stand in line and take hold of the wires."—*Boston Herald.*

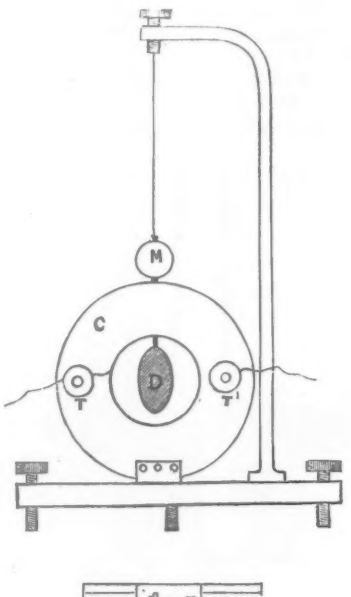
A Copper Disk Galvanometer for Alternate Currents.

By J. A. Fleming, M.A., D.Sc.

Nearly a year ago some theoretical investigations on alternate currents led me to the conclusion that a conducting non-magnetic body, suspended in the field of a coil traversed by alternate currents, would be acted upon by forces in certain positions due to the reaction of the variable currents in the coil and the currents induced in the conductor. Until a few months ago the experiment was not, however, tried. On March 12th, 1887, at a meeting of the Physical Society, was exhibited an apparatus, which I have since rendered more delicate, for making evident this phenomenon. On a wooden bobbin similar to a galvanometer bobbin is wound a coil of 200–300 ohms of carefully insulated No. 36 wire The wire should be preferably double silk covered, well baked and paraffined before winding, and the whole bobbin boiled in paraffine after winding. Two coils of this description may be mounted on a base board like galvanometer coils. In the aperture of the coils is suspended a light disk of copper foil, so hung by a glass fiber or silk bifilar suspension that its normal position is one with its plane at an angle of 45 deg. to the axis of the coil. This disk may be cemented to a very light glass fiber or aluminum wire, carrying at its upper end a mirror *M*.

The whole arrangement should be protected from drafts by a glass shade. If a continuous electric current is sent through the galvanometer coils there is no motion nor change of position of the copper disk, but if a rapidly interrupted current is sent through the coils, or an alternate current from a small induction coil is allowed to traverse the coils, then there is an immediate deflection of the copper disk, which tends to take up a position with its plane more nearly in the direction of the axis of the coil. In the first figure the apparatus is shown in elevation, and in the second figure in plan. The normal position of the copper disk is $a a'$, and the position it endeavors to take up under the action of the alternate current is shown by the dotted lines $b b'$. The instrument accordingly forms a galvanometer for alternate currents; but which, unlike the electro-dynamometer, is not affected by continuous currents.

The rough general theory of the action is to be sought for in the fact that the copper disk possesses a very sensible time constant, and hence there is a lag or delay in the rise to a maximum of the currents induced in the disk by those in the coil. Consider, first, the simplest case. Let a current be first started in the coils and then maintained constant. The rise of the current in the coils generates by induction an oppositely directed current round the periphery of the copper disk. This induced current in the disk lasts during the whole time that the current in the coils is rising to a maximum. During the rise and decay of the induced current in the disk it is virtually a magnetic shell, and one face of the disk is north polar and the other south polar. The well-known laws of electro-magnetism indicate that the disk must endeavor to turn itself, so that the direction of the currents in the disk is similar to the direction of the current in the coil. Hence it does this as far as it can by making a small displacement in such direction as to place its plane more nearly in the line of the axis of the coil. If the disk had no sensible self-induction and no finite time-constant, the stoppage of the current in the coils would be immediately followed by a like directed induced current in the disk. The forces on the disk are in this case opposite to those acting on it at the starting of the current, and as the quantities of the induced currents are equal, if the disk possessed no self-induction, the rapid break and make of a current in the coils would exercise no effect in disturbing the position of the copper disk. As a matter of fact, the disk does possess self-induction, and the operation of this is to delay the time when the currents in the disk reach their maximum. When the current in the coil is started and stopped with regular frequency, it is easily seen that, in consequence of this self-induction of the disk, the time of maximum reverse induced current in the disk will happen when the inducing current has arrived at a larger value on its way up to its maximum, whilst the time of maximum direct induced current in the disk will happen when the inducing current has more nearly fallen to zero again. Accordingly the disk experiences alternate impulses, which are opposite, but not equal, and is then pushed into a fresh position in the field in which the force of torsion of the suspension is equated to the difference between these forces, and it takes a steady deflection under this intermittent current in the coil. If, instead of supplying the coil with an intermittent current, it is fed with an alternate current from a small magneto machine or induction coil, the effect is increased because the change of strength of magnetic field, and, therefore, the forces brought into play, are greater. The explanation of the behavior of the disk is, however, the same. The experiment illustrates very well the fact that such a disk possesses a very sensible time constant, and that there is a lag or delay in the rise to a



Figs. 1 and 2.

maximum of the current induced in the disk.

If, in place of a copper disk, a soft iron disk is employed, the effects become complicated by the tendency of the disk of iron to set its plane along the lines of force of the field; but the instrument becomes at the same time more sensitive to induced currents, and can be made to render galvanometrically visible the currents in a Bell telephone, when it is spoken to. I am intending to investigate more completely the behavior of disks of various metals and forms, with the object, if possible, of obtaining more information as to the best form to give the instrument, in order to render it useful for the detection or measurement of very feeble alternate currents. It is evident that an instrument which will take the place of the telephone as a detector of alternate currents, yet appeal to the eye instead of the ear, would be a useful acquisition in the laboratory. It would form an interesting investigation to determine the exact forces on the disk in determined cases; but the above outline of a theory will perhaps render intelligible the action of the instruments.

Tinning Iron.—The surface of the iron is cleaned from scale by vitriol or sulphuric acid, and then scoured with sand. It is now coated with a strong solution of chloride of zinc, and dipped into melted tin. The tin will instantly adhere to every spot that is clean.

GENERAL BUSINESS NOTES.

Col. S. J. Fox, of New Haven, Conn., who supplies electric light companies with the reliable and effective National Feed Water Heater, was a city visitor last week. There are about 2,000 of these heaters in use, every one giving complete satisfaction.

Mr. P. C. Ackerman, formerly with Holmes, Booth & Hayden, at Boston, has accepted the New York agency of the American Electrical Works, and will make his headquarters in the new telephone building on Cortlandt street. Mr. Ackerman has many friends in the electrical business, who will be glad to meet him in the metropolis.

The American Company closed a contract last week for placing 100 arc lights in the city of Portsmouth, Va., to be used for public lighting. The Portsmouth Gas Company will operate the plant. In the new Cortlandt street offices of the American Company samples of their dynamos can be seen, ranging in sizes from six lamps to fifty lamps.

President Eugene F. Phillips, of the American Electrical Works, Providence, R. I., was a two day visitor in New York last week. In the manufacture of their new cable his company is particularly busy, the remarkable insulation test of which we recently mentioned. The New York offices of the American Company are now in the new telephone building, 18 Cortlandt street.

The American Manufacturing and Supply Company (limited) is now established at Nos. 10 and 12 Dey street, New York, where the new self-winding clocks and regulators manufactured under the Pond patents are on exhibition. These clocks are wound at regular intervals, by electricity, and are coming into quite general use. Illustrated catalogues are now ready for all desiring information concerning these clocks.

The Excelsior Electric Light Company has just installed a large plant in Harrisburgh, Pa., consisting of 250 arc lamps, 55 miles of line wire and six Ide engines, the engines being manufactured by the Foundry and Machine Department of the Harrisburgh Car Manufacturing Company. The occasion of the first turning on of the current was the evening of June 1st, and everything worked like a charm. The citizens celebrated the event, and the press of Harrisburgh speaks in glowing terms of the excellence of the lighting. The Excelsior Electric Light Company, of Harrisburgh, will operate the plant.

Executive Committee Meeting.

To the Editor of Electrical Review:

A meeting of the executive committee of the National Electric Light Association will be held at the office of the Boston Electric Light Company, room 3, No. 17 State street, Boston, Mass., on June 10th at 10 A. M., for the purpose of deciding upon a day to hold the summer meeting and other business that may be offered. Yours truly,

F. A. Gilbert,
Boston, June 2d, 1887. Chairman.

—— Mr. Wm. S. Frear has been promoted from the position of secretary of the Brush Electric Light Company of Buffalo, to that of general manager of the company. The office is a new one, made necessary by the growth of the company's business. Mr. Frear has been secretary for the past four years, and his promotion has been fairly earned by efficient and faithful services.

—— The San Francisco Board of Supervisors have passed to print a resolution granting permission to the Telpherage Electric Railway Company to place and maintain, until August 1, 1887, a steam plant of ten horse power on premises at the northwest corner of Folsom and Twenty-fifth streets, for the purpose of generating electricity to be used as a motive power on cars of the North Beach & Mission Railroad.

An Eight Light Dynamo.

By George M. Hopkins.

The making of a good commutator is not the smallest item in the construction of a dynamo. It is a very important part of the machine, requiring good workmanship and the best of materials.

The commutator cylinder in a machine of this class is formed of a series of bronze bars, separated a short distance from each other, and carefully insulated. On the 8-light dynamo it is 1½ inches in diameter and 2 inches long. The bronze sleeve *A*, which is fitted to the shaft and provided with a fixed flange and a set screw at one end, is screw-threaded at the opposite end to receive the screw-threaded bronze flange *B*. On the sleeve *A*, between the fixed flange and the removable flange *B*, is placed a vulcanite sleeve *C*, and to the ends of this sleeve are fitted two collars *D*, of vulcanized fiber or analogous insulating material. These collars are beveled on their inner surfaces, and are thickest at their peripheries. To the vulcanite sleeve *C*, is fitted a bronze cylinder *E* having conical ends, fitted to the beveled collars *D*, as shown at 5 in Fig. 1. The bronze cylinder is slitted longitudinally in a gear cutter, or in any other convenient way, so as to divide it into twenty-four equal divisions, the slits extending nearly through the cylinder, as shown at 1. Before the bars are separated they are marked with figure punches, in regular order from 1 to 24, so that they may be rearranged after separation. Besides this, a sheet of mica is selected which can be crowded into the slits. Now, if the slits have been made deep enough, the bars may be broken off one after another, and the fin may be removed with a file; but if the bars cannot be broken off in this way, they may be removed by means of a hack saw, as shown at 2.

As many strips, *F*, of mica are cut from the sheet as there are bars in the cylinder, the mica strips being made a little wider than the bars and of exactly the same length, as shown at 3.

The commutator bars thus formed are placed between the collars, *D D*, in alternation with the mica strips, with the bars arranged according to their numbers. The flange *B* is then screwed up tightly, clamping all the bars and the mica strips firmly in their places, each bar being thoroughly insulated. The cylinder thus made is placed upon an arbor and carefully turned off to bring it to a true cylindrical form. After turning, each bar is drilled near one end to receive the brass screw by which the armature wire is connected with the commutator bar.

The commutator cylinder, now finished, is secured in its place on the armature shaft, with the screws adjoining the body of the armature.

Now, for convenience in handling, the armature shaft is placed in the lathe, and the inside and outside terminals of one coil are carefully straightened out parallel with the sides of the armature, and their ends are stripped of the insulating covering for a short distance and thoroughly scraped. The screws in two of the commutator bars, say 1 and 2, are loosened so as to permit of placing the looped ends of two wires under them. The outer terminal of the coil is connected with one of the screws, and the inner terminal of the same coil is connected with the screw in the next bar in order in the commutator cylinder. The outer terminal of the second coil is connected with the screw last referred to, and the inner end is connected with the screw of the next bar in advance, and so on around the entire commutator cylinder, the outer end of each coil being connected with the inner end of the adjacent coil and with a bar of the commutator cylinder by one of the screws, as shown in Fig. 2.

The brushes which bear upon opposite sides of the commutator cylinder are each made of six thin strips of hard rolled copper, $\frac{1}{16}$ths inch wide and 3 inches long, split from their free ends toward their clamped ends, to render them more elastic. The brushes are clamped in mortised studs passing through holes in the ends of a bar fitted to and adjustable on a boss formed on the inner side of the bronze yoke around the shaft. By this arrangement the brushes may be adjusted for taking off the current to the best advantage. The mortised studs which hold the brushes are separated electrically from the bar by insulating thimbles and washers, and upon the outer ends of the studs are screwed binding posts, in which are inserted conductors bent into spirals to permit of the adjustment of the brushes. One of these conductors communicates with one of the binding posts on the machine base, while the other communicates with one of the rods extending to the top of the field magnet. The remaining binding post on the base is connected with the other vertical rod, extending to the top of the magnet. These vertical rods are connected with the terminals of the winding of the field magnet.

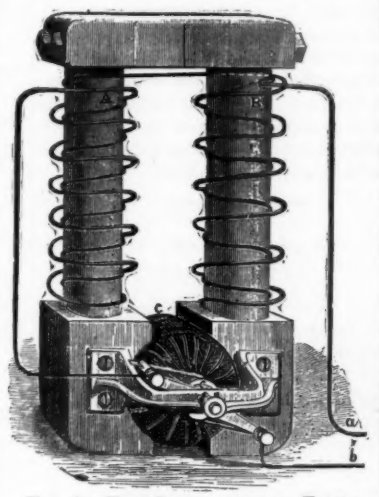


Fig. 3.—The Circuit of the Eight Light Dynamo.

The circuit of the machine is clearly shown in Fig. 3, the current passing from the armature *C* through the upper brush, thence to the top of arm *A* of the magnet, down that arm, then up to the top, then down the arm *B* and up, then downward to the base of the machine, terminating at *a*. The lower or remaining brush is connected with conductor *b*. From the terminals *a b*, the current is taken off for use.

In Fig. 3, for the sake of clearness, only a single conductor is shown on the field magnet, but in practice there are four, each conductor passing down and up once on each

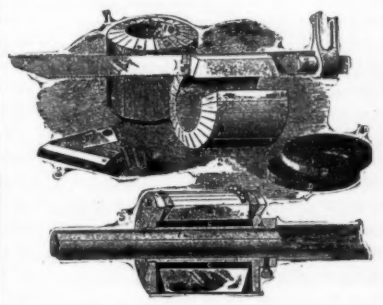


Fig. 1.—Commutator Cylinder of an Eight Light Dynamo.

arm of the magnet; that is to say, there are eight layers of wire on each arm of the magnet, formed of four wires, each wire being laid on by beginning at the yoke, winding down to the shoulder of the polar extremity, then up again to the top, leaving the inside and outside ends projecting, as shown in Fig. 4. The winding is best done in a lathe.

In the present case all of the inner ends of the wires of the arms of the magnet are connected together, and all of the outer ends of one arm of the magnet are connected with one of the vertical rods, while the outer ends of the wires of the other arm are connected with the other vertical rod.

By winding the field magnet with No. 18 wire in the manner described, several advantages are secured, one of which is the facility with which the work of winding may be done; another is the possibility of connecting the wires in different ways, so as to secure more or less resistance in the magnet. Another is that the wires may be conveniently connected up, according to the various methods of winding, compound, shunt, series, etc.

As shown in the engravings, all of the wires of the field magnet are in parallel circuit, practically forming a large conductor of small resistance, and the conductor thus arranged is connected in series with the armature, that is, the current from the armature passes directly through the field magnet and external circuit.

Having made the dynamo and connected it up in the manner described, the brushes are to be brought into contact with the commutator cylinder at points diametrically opposite each other, and at points about opposite the center of the space between the polar extremities of the field magnet. The armature is revolved in the direction of the free ends of the brushes, and in the binding posts on the base are inserted short wires, which may be brought into contact with each other momentarily as the armature revolves.

If a spark is seen on the separation of the wires, it shows that the magnetism inherent in the iron of the field magnet is sufficient for the starting of the machine, and no further manipulation other than the adjustment of the brushes is necessary. The brushes should be adjusted to a point where the least sparking is produced. This will not vary much from the original position. The machine from which the engravings were made produces no noticeable sparks at the commutator.

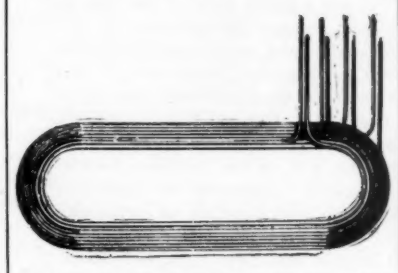


Fig. 4.—Section of One Arm of Field Magnet, showing Winding.

If the machine fails to start, when tried in the manner above indicated, a battery of four or five Bunsen cells must be connected with the binding posts, or a dynamo may be used instead of the battery. It sometimes requires a few minutes to start the current, but as soon as it begins the battery should be

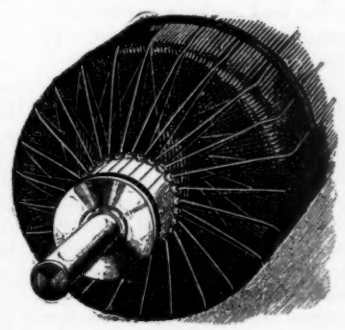


Fig. 2.—Connections of Armature Coils and Commutator Cylinder.

removed. Some care is necessary in handling the conductors, as it is quite possible to receive a severe shock from this machine.—*London Electrical Review.*

A Query.

To the Editor of Electrical Review:

Will you kindly inform me if there is any way that the electricity generated by belts can be conducted into a storage battery, and then used for incandescent lighting?

Clinton, Mass. I. J. F.

Answer.—This is possible, but not practicable. The amount of energy stored would be very slight, as there must be a number of transformations and loss in each. By passing the electricity from the belts into Leyden jars, and thence through the fine wire of an induction coil, alternating currents of some volume would be obtained from the coarse wire coil. A polarized relay could be devised to send the currents in one direction through the storage battery. Some difficulties would be encountered in preventing momentary short-circuiting of the battery through the coarse wire coil of the induction coil.

Foreign Electric Lighting Notes.

The electric light, which has been successfully established in the state apartments of Windsor Castle in England, will now also be put up in the private apartments of the Queen.

It is announced that Shippey Bros., of London, have assured themselves, by treaty, the monopoly of electric lighting in certain quarters of Constantinople, for a period of fifty years. The works will be made under the auspices of a powerful Turk syndicate, which has been formed for the purpose of introducing electric lighting in Turkey.

It is proposed to install the electric light in the little city of Guadalajara in Spain. The motive force will be furnished by a turbine of 40 horse power already put up at a distance of two miles from the city; and they will use the transformers of Zipernowsky-Déri. The promotors are ready to commence the works as soon as they are sure of subscriptions for 200 lamps of 12 candles. The city has 8,000 inhabitants, and does not possess a gas factory.

Bordeaux will soon possess a central station for electric lighting, with generators of the Gaulard & Gibbs. It is announced that the director of the station of Tours has formed a syndicate at Bordeaux, with a capital of $10,000 to commence the works.

The central station at Dijon will be changed, and secondary transformators used. This modification has been decided on for the reason that the inhabitants complained continually of the noise of the machine. The new station will be constructed outside of the city.

The exposition which will soon take place at Newcastle, in England, will comprise an important installation of electric transmission of force. There will also be a telpherage line.

The new electric lighting company which has lately been formed in the capital of Luxemburg, will put up their central station in the old building of the water service: there will be two steam motors, which will work two dynamos of 1,000 lamps each. They will also use a strong battery of accumulators. The company has already taken in 100 subscriptions with a total of 1,500 lamps. The subscriber will have nothing to pay for installing in the houses, and the electric lighting will be paid for according to the number of hours which it has been used. The price is 3 centimes per hour, and per lamp of 8 candles, and 5 centimes per hour per lamp of 16 candles.

All the apartments in the palace at St. Petersburg are lighted with incandescent lamps to the number of 12,000, while the court in the interior of the palace, and the great square before the principal entrance, are lighted by 56 arc lamps. The machines are put up in the basement, and comprise steam engines of 2,500 horse power, acting 26 dynamos. This colossal installation works perfectly. It was made by the Siemens & Halske Company at St. Petersburg.

Experiments in electric lighting on the trains have been tried in India, where the distances necessitate night travel. The cars have until now been lighted with oil lamps.

Cleaning Screws from Rust.—Screws that are too small for separate treatment may be cleaned as follows: Take one pound of screws and place them in a small box, a cigar box will do; put a small quantity of oil on them and shake for a minute; then put a piece of cotton waste in the box, and repeat for a minute; finally put a handful of sawdust in the box, and shake for another minute or so, and remove the sawdust by sifting it from the screws in a fine sieve. The screws will be found to be as good as new.

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There will now be some lively work with electric motors. The Baxter, the Sprague, and the "C. & C." are actively in the field, and there are others coming.

The paper of Mr. Slattery before the Society of Arts (ELECTRICAL REVIEW, June 4th) is an account of practical experiments in the distribution of electricity by alternating currents on a commercial scale. The principles underlying the generation and application of counter electromotive force in the primaries of induction coils and the advantage taken of this in arranging the induction coils in multiple arc and the disastrous effects of this same C.E.F. in a series system of distribution were clearly explained and practically shown by the apparatus on the platform. Although it has been stated that dynamos could be thrown on or off in multiple with other alternate current machine, the latitude in speed or E.M.F. as that mentioned by the speaker, was a surprise to his hearers.

Mr. E. T. Gilliland is now convalescing after a severe illness of two weeks, at his residence in this city. The attack was no doubt brought on by the wetting he received through the breaking of a Florida pier, which precipitated him and a half dozen members of his party into the water, from which they were rescued with great difficulty.

The State Legislature has just appropriated $75,000 for the erection of scientific laboratories at the University of Michigan. The new building will furnish ample room for the Department of Physics. The appropriation also includes $4,000 for additional physical apparatus. It is intended to expend most of this for electrical appliances, in order to provide facilities to meet the demand for instruction in electrical measurements on a commercial scale, in connection with the course in mechanical engineering. The addition of these new laboratories to the existing ones of chemistry and mechanical engineering will enable the University to offer very superior facilities to students of science.

The first of the seashore meetings of the Electric Club will be held at the Hotel Brighton, Coney Island, June 23, at 6 o'clock, P. M. It was a happy idea of the club to make such pleasant arrangements for the hot summer months, and the next three meetings will no doubt be greatly enjoyed and greeted with the usual large and enthusiastic attendance. Dr. Otto A. Moses, whose illness prevented him from being present at the last meeting, will, on this occasion, describe his new electric seismometer for registering the approach and direction of earthquake waves. The hotel is easy of access either by rail or steamer from New York, and attendants should start in good time to be present by 6 o'clock.

In the United States Circuit Court at Dallas, Texas, Judge McCormick has granted an order of injunction against James G. Watkins, of Fort Worth, and J. C. St. John, of Dallas, which enjoins the further use by them of telephones that infringe the Bell patents, and orders all of such telephone instruments now in use in Dallas and Fort Worth to be placed in the custody of the United States Marshal. This, for the present at least, determines the question of competition in the telephone business in these cities and completely breaks up this particular set of infringers. Messrs. Watkins and St. John had been under restraint, and for the second time attempted no defense This injunction holds until final hearing.

The experiments at the Massachusetts Institute of Technology on the Blake transmitter would seem to prove that better effects are produced by storage than primary batteries. Whatever the reason may be, low internal resistance, absence of momentary polarization, variations of resistance and electromotive force due to jarring, secondary cells admit of the use of longer lines than primary batteries. Professor Dolbear has shown that a transmitter may be made of a primary battery. The vibrations caused by talking into it vary either the resistance or electromotive force and currents of varying strength are set up. Now, if a primary cell be exposed to jarring, what wonder is there if an obscure, deadening sound is heard at the receiver. The success of storage cells in the postal department of Great Britain proves that there is no difficulty in constructing a storage battery which will remain charged for months.

NEGLECTING OPPORTUNITIES.

An intelligent and capable engineer in a leading educational institution managed the steam plant, and acted as assistant to the professors for a number of years. At last the question occurred to him why could he not learn some one subject that would be of advantage to him in his profession. Choosing electricity, as his help was often required in investigations in this subject, he inquired of one of the professors of physics if he could learn something of the theory and practice of electrical measurements. The professor gladly gave him encouragement, and offered to assist at any time. The engineer found great pleasure in learning to make measurements, and his advancement was more rapid than that of the regular students.

Two machinists in a New England town agreed to meet one evening and enter a free class in mechanical drawing given by the town. One was detained, but sent word to his friend to go alone. The second went as far as the door of the school and turned back, because he did not like to go in alone. He was one of the very class of men for whom such courses are established. The ablest superintendents and managers are practical mechanics who have not neglected their opportunities. Mr. W. J. Hammer, manager of the Edison Illuminating Company, of Boston, calls the employes together weekly to listen to a lecture on electricity, paying special attention to the theoretical and practical points illustrated in the Edison system. A small library of electrical books is at their disposal, and, to judge from the good spirit and efficiency of the men, they have benefited by the help they have received.

THE STEAM ENGINES VS. ELECTRIC MOTORS.

Large factories were comparatively unknown thirty years ago. They are a result of the substitution of machine for hand labor. Years ago in hundreds of New England villages, the farmers spent their winters in making shoes. Machines were invented and introduced and large factories took the place of the farm house or dwelling house in the villages and towns. The work must go where power could be obtained to operate the machinery. Even from small sewing machines the output of work when the operative does not drive the machines is much increased. Power could be produced more cheaply in bulk, as it were, from one large engine, than from a number of small ones. Though the factory building cost far more than the use of rooms in houses and over stores, though there were serious disadvantages in bringing operatives together in large numbers away in many cases from home influences, still the question of power outweighed all objections. Closely packed in the large cities there are small workshops of all kinds, in some cases over fifty establishments being operated from one steam engine. For all powers up to 15 horse operated continuously and for larger powers operated intermittently, the established charges for current to operate electric motors is considerably less than the expenses for a steam engine, and very remunerative to the company furnishing the current. In Boston more power is distributed by electric motors than in any other city in the world. So profitable has the business proved to be that the Edison Illuminating Company are to build a second station in the north end for the purpose of furnishing electric power. The same engines, dynamos, mains, etc., will be used to operate incandescent lamps, but the primary object of the station is to furnish power, and it will be the first station of its kind in the world. The Bumpstead court station of the same company has solved the problem of the electric transmission of power in cities, and the management of the business has been reduced to a practical working system. It requires but a moderate application of the fundamental principles of arithmetic to prove that a power (electric) central station is more profitable than a "light" station, and that a combination of the two leaves nothing to be desired in economy of management and operation. The establishment of central electric stations to furnish power and light in the cities and towns will in the course of a few years build up a vast number of small factories and give scope to the inventive genius of America. The manager of a small shop has every inducement to make changes, devise improvements, produce inventions he would never have the time, opportunity, or inclination to undertake if employed as a hand in a large shop or factory.

OUR CHICAGO LETTER.

(From a Special Correspondent of the ELECTRICAL REVIEW.)

An agent in a communicative mood, the other day, related several anecdotes of salesman life which will bear repeating, and show how "anybody can run an electric light plant economically."

In one case a telegram from a town far away in Missouri arrived early one morning, or rather beat him to the office, requesting that a man be sent some four hundred miles to put a new field magnet in running order. The machine had been struck by lightning and the field burned out. A new one had been substituted, and that was no better. Everything was very urgent, and the man was sent at once, his grip following by express.

A careful investigation showed that, save a disconnected section of the armature, there was nothing the matter, and this repaired the plant worked as well as ever. The expert did five minutes' work, and it cost somebody $500.

But the chap who saw the lightning strike the core of the field, and who smelled fire, was just as certain as ever. The old coil was unwound and reported sound, but all to no purpose. That chap, while not quite so firm, perhaps, as he was, still *thinks* to-day that he saw the lightning burn out that field magnet.

On an upper Ohio River steamboat an agent of the same system had a 4,000 candle power headlight running, to the utmost satisfaction of the entire crew, from captain to cabin boy and cook to roustabout, to say nothing of engineers and pilots. Cold weather came, the lamp and dynamo went into winter quarters, and the crew separated. When spring came the new engineer couldn't make the lamp work. It would run a few minutes and then go out. Then the captain, and the pilot, and the engineer, and the striker, would remark something derogatory to the lamp, and the d-d-dynamo, and the cur-cur-rent, and ass-agent, and then try it again with no better result.

The agent received a blue-tinted letter of rather a spicy character containing words that would hardly pass through the average social seive, and a remark or so intimating that the dynamo might possibly return to the company, accompanied by a bill of claims, if the matter wasn't speedily attended to. The agent meekly replied that a man would call and go through the case. He went, and was received with a sort of verbal torchlight procession, so to speak, such as an Ohio River captain delights to marshall on festive occasions.

To cut a long story short, the expert found that a portion of the carbon holder had been bent—probably in packing away last fall—and this he straightened with his thumb and finger. When lighting time came the light went off just as well as ever. It is running to-day good as new; and again a good big bill was paid by somebody.

A Chicago man recently joined the great majority by announcing that he had a new, and to say the least, a very remarkable electric light. It is one of that variety which is warranted not to rake, scratch, or cut in the eye, broom or split in driving, and is better as it grows older, to such a degree as to guarantee a ten per cent. per annum increase, until the original investment is paid back in dividends. It beats a ten year or an endowment policy in a life insurance company, and can be sold for less than cost at a fair profit, or words to that effect. He knows nothing about electricity, and doesn't want to. He claims to have a lamp which has a perfect system of regulation in every direction, in feed, length of arc, and all that sort of thing; remains as steady and uniform, and as persistent, as the energy of a summer Sunday afternoon fly at napping time. Amount of current, number of volts, ohms, or watts have nothing to do with it; "you just touch her off, and she goes, 'n that's all there is about it!"

Mr. Chas. W. Raymond, the enterprising general agent of the Ball Company here, has been domiciled heretofore in a sky parlor of the Montauk block, eight long tedious stories—when the elevator didn't run—from the balance of mankind. C. W. has now come down from his perch, and may hereafter be found without a balloon, at 39 Dearborn, Tremont House building.

Some of the boys say that Raymond descended for the same reason the spire of a certain church was taken down, the church had no property rights so far in that direction.

The honest, up and down square ways of a new country are very happily shown in a recent transaction in electric light plants at the Chicago agency of the Brush Company. One afternoon in February last two gentlemen called, introduced themselves as Messrs. Angel & Boyle, of Hailey, Idaho, and asked figures for a Brush-Swan incandescent plant of 500 capacity. When the estimate was made, the price agreed upon, and all preliminaries settled, the gentlemen asked for the bill.

"But, gentlemen," said the agent, "we will have to manufacture and ship the goods. We cannot deliver them to-day."

"Oh! that's all right," was the reply; "we have bought the geods, and you will deliver them. Please give us a bill, and we will give you our check on your First National;" and they did it then and there.

It is probably the only case on record where a plant was paid for before it was delivered, or even shipped.

The Hailey daily paper, the *Evening Inter-Idaho*, is out in flying colors on the subject of electric lighting. The company, of which the two gentlemen mentioned are prominent members, have made a perfect success of the plant. There are now some three hundred lights running—a fact which has whetted the appetites of the good people of Hailey, and measures are now on foot to light the entire city with Brush arc lamps.

With the extreme Western man there is no mid-way in business. It is a parallel case to that in the old song:

"Where, right or left, you go,
Sure you know, friend or foe
Will have the hand or toe
From the Bowld Solger Boy."

The Chicago Electric Club, while still in an embryo state, gives every promise of success. At the meeting on the 2d instant, twelve new members were received, and there are still between seventy and one hunpred persons engaged in electrical enterprises here, who are eligible, and should become members. There is a large following outside the city, in territory tributary to Chicago, and in addition to this it is the universal opinion of the membership that the social features of the organization will bring to our ranks a very respectable list of gentlemen who will add strength and stability, and tend to popularize the undertaking. These are the patrons of electric lighting—merchants and others, who are, so to speak, step and half brothers to electrical enterprises. As only one skirmish, and one adjourned meeting, have, so for, been held, we think the prospects most encouraging.

The Chicago Arc Light and Power Company has bought and taken possession of the Western Electric Central plant, running something over one hundred lights, and the town of Lake plant, also.

The Badger plant is now being bidden for, and will probably come into the fold before many suns. There will then remain outside, the Sun, Schuyler, Columbia, and Ft. Wayne Jenny central plants, besides a lot of little chaps, which, like chips in porridge, are of but little account either way.

Prof. Barrett, who is the natural father of the scheme, at the request of the council, furnished an estimate of $56,000 for a plant of 100 double lamps to light both sides of the river, and its branches from Chicago avenue to Twenty-second street. Subsequently the Professor was convinced that a saving might be made on these figures of some five or six thousand dollars.

In the meantime, a proposition was made by Farwell & Co., to rent power to the city for one hundred lights of 2 000 candle power, 365 nights per year, at $8,830 per annum.

Various suggestions and propositions served to keep the matter alive; a new Mayor and a change in councilmen intervened; and the bridge nuisance helped to egg on investigation. The Professor was not idle, but at every suitable opportunity has urged the necessity, until it is more than probable we shall very soon have a clear run over the bridges during the day, and the vesseling will be accomplished during the night time.

Of course there is opposition to the scheme—there always is to any scheme by which any class of business is interfered with, however small, for the benefit of another class, however large.

There was almost open rebellion on the part of the river people years ago, when the ordinance was passed requiring the tug chimneys to be jointed so they could pass under the bridges without their being opened. There was talk of revolution when the council provided for the closing of the bridges for two hours morning and night, and at no longer than ten minute intervals during the day. And the navigators and their backers are opposing the present scheme, which was outlined by the Mayor at the council meeting on the 3d. Something thus:

The closing of the bridges on the South branch to Twelfth street, and the North branch to Chicago avenue, except from midnight to 6 A. M. during the season of navigation, Clark, Madison, Adams and Twelfth street bridges to be closed once in each hour for three or four minutes for street cars, belated pedestrians and vehicles. A limited amount of authority to be delegated to bridge tenders during stormy seasons and emergencies. Connection by wires between the fire department central office and bridges, so that the latter may be closed in case of necessity. The lighting of the watercourses by the use of 100 double carbon 2,000 candle power lamps, operated by four 30 light dynamos with sufficient boiler and engine power. The estimated cost of this plant is $47,750, and the operating expense, including 6 per cent. on the investment, is $10,165, so that the cost per lamp for 10 hours daily service would be $101.65 per annum—about 43 per cent. less than is paid in Eastern cities for similar service, and it would, at a low estimate, displace some 400 gas flickers at $28.80 each per year; a credit to the account of $11,520.-00 or $1,355 in excess of yearly cost.

The entire matter was referred to the joint Committees on Harbors and Bridges and Fire and Water.

The ordinance taxing telephone companies $25 per year for each instrument in use for hire in the city, was made the special order for the meeting of the 13th June.

West Madison street is now undergoing an upturning, and the Chicago Telephone Company is putting down cables to relieve the pole route from Halsted to Western avenue. So, too, the city wires are being put under along the same route.

Motor business is on the up grade in Chicago and vicinity. The C. C. folks are running some light machinery in the city, and the Sprague people are operating the transfer tables of the C. B. & Q. Company at Aurora, and lathes, drill presses and other machinery for the Chicago Fire Department.

CHICAGO, June 6, 1887.

M. H. Langlois has proposed a novel form of battery. The box or jar is made of stoneware, wood or metal, and its inner sides are covered with plates of carbon firmly attached. These plates are clamped to a copper circle by bolts.

The use of mercurous nitrate on commutators is not to be recommended. The attendants in a short time become salivated.

OUR BOSTON LETTER.

(From a special correspondent of the ELECTRICAL REVIEW.)

F. G. Cartwright, the representative of the Sun Electric Company for New York city and vicinity, is in the city on a flying visit, and reports that great interest is shown in the long distance automatic converter system.

The Edison Illuminating Company are laying feeders in Washington street towards the south. The work is prosecuted at night as well as in the daytime, the incandescence of oil lamps supplying light during the hours of darkness. The well-trained gangs do the work as fast and as well as in the daytime.

E. P. Sparrow, of the Household Electric Light Company, has removed to 31 Milk street.

Consolidation is epidemic. The Citizens' Electric Light and Power Company, of East Boston, has been leased for 999 years by the Boston Electric Lighting Company. The station on Condor street was burned some time ago and the dynamos and engines damaged or destroyed. The company showed great enterprise. They at once set up a temporary station in a shed near by. Circuits for commercial lights in Chelsea and East Boston, and for street lights in the latter place were at once operated. The city of Chelsea will this fall contract for arc lights on the streets. Incandescent lamps on the arc circuits are giving good satisfaction, and the introduction of a converter alternating system will supply both places with incandescent lighting.

The Spencer Gas Company have contracted to furnish 60 arc lights for 3 years at 33½ cents per night till 12 o'clock for street lighting. The Ball plant already in use by the company will be increased to supply the demand for street lights. The vote in town meeting was 600 to 4 in favor of instructing the selectmen to contract with the gas company for arc light of the Ball system.

In the directors' room of the Boston Electric Lighting Company, the desk of the president, Fred. Gilbert, is guarded by two bulldogs, pa and son. They are of noble pedigree, and their look is more than their bark, which is of insulating press board.

The offices of the Blake Manufacturing Company, 113 Pearl street, have been lately equipped by the Electric Gas Lighting Company with 72 plain and 12 argand pull downs, two automatics for the private offices of Messrs. Blake and Turner, four No. 9 annunciators 45 bells, 2,300 feet of speaking tube. Each department can communicate with every other. Though an old building, with deadened floors, not a wire is to be seen. The work was done under the supervision of H. M. Cutler.

The Board of Fire Commissioners is to test a novel method of signaling from the pipeman at the end of a line of hose to the engineer. E. H. Crosby is the inventor of the system. Wires are laid inside each length of hose, and the brass couplings of each length are provided with electric couplers. The only objection now urged is that a new set of hose will be required for the entire city, as the substitution of one length not provided with the wire in a line, on account of a broken length, renders the line useless for signaling purposes. Two years ago the Western Union Telegraph Company placed the wires running from their office at 109 State street to the Northern depots underground. The route was State street to Adams square, across Washington street to Friend street. An iron pipe was used, and manholes placed at convenient intervals. To a frequent passer in these streets it seems as if work is being done at some manhole all the time. Sixty-five wires were placed in the pipe, and already twelve have failed and been been replaced. The joints in the manholes give the most trouble, corrosion spoiling the most carefully made connections. The success of the New England Telegraph and Telephone Company, with their system of cables in conduits in place of single isolated wires, has been as noticeable as the failure of the Western Union plan.

The Senate has passed to be engrossed a bill constituting the Board of Gas Commissioners a board of gas and electric light commissioners. When the board was first created, it was thought to be a resting place for worn-out politicians. Not so. They have kept the gas companies under the strictest supervision, but have not prevented the manufacture of water gas in Athol or the explosion in the retort room of the Lynn Gas Company. The Worcester Gas Company exceeded the 10 per cent. limit of carbonic oxide again and again, and not until the citizens of that town took the matter in hand was any action taken. How the commissioners will succeed in detecting "grounds," crosses, poor insulation or personally examine at times unknown to the electric companies, the various electrolytic time, and mechanical electric meters in use and that too without receiving a double prescription of the all-curative fluid, remains to be seen. Of course the commission will carry dynamometers, ammeters, voltmeters in their pockets—the dinner-meeters taking place at first-class hotels. We see a large future before the combined commission.

The West End Railway Company bill has passed the Senate and is well on its way before the House. The wise ones say that it will be passed within ten days and be at once signed by the Governor.

The railroad committee of the Legislature have been instructed to investigate the subject of the lighting and heating of railway trains and to report to the next General Court, making such recommendations and suggestions as they may desire. The feeling is that steam for heating and some system of incandescent lighting will be recommended.

"The directions on this order are for clearness only equaled by some a furnace man gave me," remarked an electrician. "There were two doors in my furnace; on opening the first the second might be seen. To prevent escape of gas I was told to open the inside door first."

BOSTON, June 7, 1887.

The Tucker Electrical Manufacturing Company.

The above-named company has recently been organized on a strong commercial basis, with headquarters at 35 Broadway, New York city. The company is composed entirely of builders and persons identified with building, and is the authorized agent of the Mather Electric Company, of Hartford, Conn., in the States of New York and New Jersey in the East, and the States of Missouri, Iowa, Kansas, and Illinois, in the West. Headquarters have already been established in St. Louis, and will be in charge of E. L. Bradley.

The Tucker Company was organized under the laws of New Jersey, with a capital of $100,000, and has connected with it a number of able and well-known electrical men. With its strong building and electrical organization, contracts can be made to complete buildings from foundations up, including lighting with a first-class system. The REVIEW is pleased to welcome this strong company to the electrical field, and hopes to see it attain pronounced success.

—— The new cored carbon of the Forest City Carbon Company is receiving commendation from operators of a number of electric light systems. A recent letter to the agents, Messrs. Holmes, Booth & Haydens, of this city, written by the engineer of the Joliet (Ill.) Electric Light and Power Company, says: "The cored carbons received from you are the finest carbons I ever came in contact with. I have put them in lamps that with other carbons would flicker, siss and blaze, and I got the steadiest light ever seen in this place."

Telephonic News

THE TELEPHONE SUBSCRIBER AND THE BRIGHT OPERATOR.

She was but an operator,
A subscriber bold was he;
She manipulated brass plugs,
None more brassy, though, than he.

Every morning would he call her,
Every morning bright and gay,
"Hello, Central, hello Central!
Isn't this a nice, fine day?

"Are you very busy, Central?
Won't you talk to me awhile?
Won't you send by phone to me, now,
Just a little, tender smile?"

Nothing could she do to stop him;
Nothing could she do or say
That would stop the everlasting
"Won't you talk to me to-day?"

'Til at last a bright thought struck her,
And she held it like grim death;
And she laughed at it so gayly,
She could scarce regain her breath.

And she told him when he called her,
In a voice *so* low and sweet,
That—that he might come and see her,
Since he wished that they might meet.

Then she fastened from the railing,
That kept curious people out,
Wires so fine you scarce could see them,
She was bright—beyond a doubt.

Wires connecting to a battery
Just a simple piece of brass;
But the current that they carried—
Who would think of that—alas!

So when he "bobbed up serenely,"
This young man so bold and gay,
First he bowed, quite low and stately—
Oh, it was a nice, fine day.

Then advancing to the railing,
A broad smile his face expands;
On the piece of brass so simple
Lays he both his eager hands.

Then a howl of bitter anguish;
Then a laugh of girlish glee;
She was but an operator,
A subscriber bold was he.

Quick the door closed on his figure,
After he received the shock;
And she never heard him after,
She—who at his pain did mock.

And though but an operator,
She has done, I think, right well,
So to shock this bold subscriber,
So to punish this gay swell.

Pottsville, Pa., May 30. SPUR.

*** The telephone exchange at Dallas, Texas, will soon move into new offices, fitted up with the multiple switchboard. The capacity of the new exchange will be nearly 700, and the expense of moving and the improvements amounts to about $5,000.

*** It has been decided to establish telephonic communication between Hamburg and Kiel, and the preparatory work is already commenced. They will use for a part of the distance the telegraphic wires, but a special line will be constructed between Hamburg and Altona.

*** The Hungarian Minister of Communications has reduced the subscription for the telephone at Temesvar for municipal offices and of the State, and also for the hospitals, etc., to 12 fr. a month. The new reduced tariff will enter into action from the 1st of July coming.

*** Mr. Jasper N. Keller has resigned the office of general manager of the New England Telephone and Telegraph Company, to enter upon the organization and development of large business interests in Boston and New York. In the two years of his administration Mr. Keller has entirely reorganized the force of the company, and placed its affairs upon a sound business basis. The loss of his services and long experience in the telephone business is greatly regretted by both stockholders and directors. Mr. Wm. J. Denver, of Springfield, late assistant general manager, has been appointed to the vacancy caused by Mr. Keller's resignation.

Music by Telephone.

A firm of Birmingham music dealers was lately required to tune an organ to accord with a piano in Moseley. It was impracticable to bring the instruments together, but a happy plan was at length stumbled upon. A note of the piano was struck in front of a telephone, and the sound was so accurately transmitted to the distant tuner that he was soon able to accomplish his task, and the organ was sent in season for its intended use with the piano in a concert.

Their Club House Secured.

ELECTRICIANS TO HAVE A PLACE OF THEIR OWN BY SEPTEMBER.

The general boom in club affairs which has been evident about the city of late has affected the electricians, and the members of this vigorous and rapidly developing branch of commercial industry are shortly to have a handsome headquarters of their own. The plan is not only social in its character, but instructive as well, as the new institution will have for its object the dissemination of practical knowledge in electrical directions, and will make it a business to keep generally abreast of the advance of electricity in the many industries into which it is now rapidly pushing.

The General Building Committee of the Electric Club held a meeting at the club rooms in the Hotel Dam last evening, President Davis being in the chair. A large attendance was present and heard the report of the special committee on a club house to the effect that they had found at 17 East Twenty-second street such a building as was desired. Its dimensions are 33 by 75. It consists of four stories and a basement. The first floor would answer perfectly for an assembly and lecture room when certain proposed changes were made. The rent was $4,000 per annum.

After discussion the report was unanimously adopted and the President and Secretary were instructed to execute, in the name of the club, a lease of the property at the price named for the term of three years, with the privilege of renewal.

With regard to furnishing it was stated by several that they were authorized by members to state their willingness to accept the bond of the club and advance any money needed for fixtures, etc. A resolution was passed authorizing the President and Secretary to issue the obligations of the club to an amount not exceeding $25,000, to bear interest at a rate not exceeding 4 per cent. per annum. The resolution provided that a sinking fund of at least 10 per cent. of the principal shall be set aside annually for 10 years, so that the payment of the obligation at maturity be provided for. The money will be used, together with the surplus now on hand, for the purchase of furniture, electric apparatus, etc.

The new club house will probably be ready for occupancy by September, as its preparation will begin immediately.—*N. Y. Times, June* 2.

A megohm resistance of German silver is expensive. An excellent substitute proposed by Hittorf is cadmium electrodes, in a glass tube filled with amylic alcohol, containing a 10 per cent. solution of cadmium iodide.

To compare the strength of two magnetic fields a small magnet is set in vibration in them, and the number of swings per minute or for any convenient interval of time noted. Square the number obtained. The strength of the first field is to the second as the square of the number of vibrations in the first field is to the square of the number of vibrations in the second field.

Ex.—It being desired to compare a permanent with an electro-magnet, it was found that the vibrations of a heavily weighted magnet in one minute between the poles of the permanent magnet was 40, between the poles of the electro-magnet, 120 per minute; 40 squared = 1,600, 120 squared = 14,400, therefore the field of the second was 9 times as strong as that of the first.

OUR KANSAS CITY LETTER.

(From a special correspondent of the ELECTRICAL REVIEW.)

The scheme of placing all the telegraph, telephone and electric light wires underground is being agitated by certain members of the City Council. These members are noted chiefly for their demagogic characteristics and the motive guiding them in this case is simply a desire on their part to make themselves popular with the "labor party" by a great show of fighting "monopoly." Not one of the members proposing the "underground" business understood what it meant; not one knew that the idea was yet an experimental one, but thought it had been perfectly carried out in the larger cities; not one knew that there would be any difficulties to overcome in placing the wires underground or had heard of induction. Interviews in a local paper giving the views of the head men of the various electric concerns regarding the scheme, has just about knocked all the props from under it. The probability is that the ordinance which, it is understood, has been prepared providing for compelling all wires to be buried, will be buried, itself, among the moulding papers of some committee.

The city is using about twenty-five arc lamps for street lighting in the business portion of the city. It finds them as reliable as the gas lights, a far superior light in all other respects, and that a larger area is lighted for the same money than would be if gas were used. Electric lights are popular here, and the city will undoubtedly increase the number of lights if not wholly supplant gas. Electricity seems to suit the spirit of the town a great deal better than the flickering, smoky and foul smelling gas. Every business house of any importance in the city is lighted by electricity. The Grand Missouri, the Centropolis and (when finished) the Midland Hotels, use electric lights throughout. The *Times* building, the *Star* building, and the *Journal* building, rely on electricity to banish darkness. Every office building now in course of erection will be lighted by electricity.

The Missouri Legislature has passed a bill creating the office of electrical inspector with an annual salary of $1,800. It is applicable only to St. Louis. W. W. Murray has been inspector of electric wires in that city, and it was thought that this position was created for his special benefit. A certain clause in the bill, however, will most effectually keep him out of the office. This clause provides that the inspector shall not be one who is a stockholder in any electric company, or who is in any manner interested in one. Mr. Murray has considerable interest in the Strong telephone patent, and is connected with an association which is now trying through the law to wrest the Bell telephone rights from that company.

Henry D. Loughten proposes to build an elevated electric railway in St. Louis, and a bill has been introduced in the House of Delegates granting him the franchise. It will probably be passed and work begun upon the line at once.

The Centropolis Hotel, just reopened, is lighted throughout by electricity. It contains 1,150 Edison incandescent lights, supplied by three 800 candle power dynamos.

The Edison Incandescent Light Company will erect a large building in this city. The plans are prepared, and work will begin upon it on the 1st of June. It will be situated in the heart of the business portion of the city, on Wall street, between Sixth and Seventh. It will be five stories high, and constructed of brick and stone. The architects state that this building will be the most perfect fireproof building in the city. The partitions will be of iron and hard-burnt brick, and every floor will be laid in concrete. The generating machinery will be placed in the basement, and will be of the best character and latest designs. On the first and second floors the manufacture and repair of all kinds of electrical apparatus will be carried on. The remaining floors will be leased to various manufacturing concerns. There will be one passenger and two freight elevators. An exhaust chimney 185 feet in height will be erected, and it will be the highest in the city. The structure will be 95 feet in width and 116 feet in length. It will cost $100,000 Each story will be perfectly insulated from the others. The electrical plant is already being made, and will have a capacity of four times the number of lights now in use in this city, and its estimated cost is $150,000. As the land cost $50,000, when the building is completed and fitted up it will represent an investment of $200,000.

The electrical street railway is not in operation yet. It has met with provoking ill luck from the start. The company had great difficulty in securing good machinery. Numerous accidents happened. Superintendent Henry became ill. The track got out of condition. Now, just after its new machinery had arrived and the hopes were the highest, the council repealed the franchise of the company whose tracks the electric company had leased, and the probability is that the street will now be taken up by a cable line. But the stockholders, who have sunk about $25,000 in the electric road so far, are determined to carry it on to success or absolute failure.

Chief Hale, of the Fire Department, is in love with electricity. He thinks it one of the grandest things of the world, and that it has reached its greatest usefulness in the telephone. It is from Chief Hale's reliance on the telephone that Kansas City is without the fire alarm systems that nearly all other cities deem necessary. He considers the telephone a much better fire alarm—more reliable, quicker and more satisfactory in every manner. He has stuck to the telephone in spite of great opposition, and now has the pleasure of knowing that the city believes with him, and is also able to "point with pride" to the fact that London has recently adopted the telephone fire alarm system. G. M.

Kansas City, Mo., June 3d.

OUR DETROIT LETTER.

(From a special correspondent of the ELECTRICAL REVIEW.)

This city is very active electrically. The electric lighting and telephone work has been mentioned in the past in your valuable and interesting journal, but one department of electrical progress here should receive attention now, and that is, electric motors. We think, and tests seem to bear it out, that our city is the producer of as good an electric motor for its purpose as there is in the market to-day, the result of the intelligent efforts of that very capable young electrician, Mr. Frank E. Fisher, manager of the Detroit Electrical Works. This electrical company is actively exploiting the motor, and in addition to work done in the past, has just obtained the contract for equipping the East Detroit and Grosse Point Electric Railway. East Detroit, is a suburb about to be incorporated, and is three miles from the city on the Mack Road. Grosse Point is a very fashionable suburb, located on Lake St. Clair, where most of our wealthy people have summer residences.

The Electric Railway will follow Jefferson Avenue to Cadillac Boulevard, thence to the Mack Road, and along that thoroughfare to Grosse Point. It will be eight miles in length, one mile of the construction being within the city limits. The company will therefore use an underground conduit for this portion of the road, and the conductor for the balance of the distance will be, in all probability, the center rail.

It is the purpose of the builders to make this the banner road, not only in its equipments and service, but speed. The power station will consist of two eighty horse power steel boilers, two sixty horse power automatic engines, and two dynamos; each dynamo being of sufficient power to handle the entire apparatus. The road will be equipped with four sixteen-foot cars, with motors on the front platform, and two large motor cars, of sufficient power to draw three open cars. The motor company has guaranteed the railway company a speed of not less than twenty-five miles per hour, and will start building the road immediately.

The Detroit Electrical Works have also obtained the contract for an electrical railway at Lakeside, Ohio, which will be three miles in length. The equipments of this road will consist of two open cars, and they will probably use overhead conductors, as it is not intended to operate the road during the winter season. E. D.

DETROIT, Mich., June 2, 1887.

An Electrical Sorcerer.

(From a Western Contributor.)

While there is known to exist at the East a large amount of ability in the electrical line it is, perhaps, well for the country that the "rowdy West" can also boast of its savants and inventors. Do we ask for a Western electrical railway? There is the Denver (Col.) road, alike an original as well as a Western system. Seek we an electrical combination which will catch a thief or a burglar or ring the dread alarm of fire? The Chicago system, with its kiosks and wagons—the system which Mr. Stack, the company's agent, recently exemplified here for the benefit of our citizens and the town board. Would you have practical scientists? Look at venerable Wiley Smith, of Kansas City, whose mantle of learning is just now reflecting its glow upon his erudite offspring Charley (God bless him) surrounded by the temptations of Salt Lake City. For a successful electrical business man, who better as a current manipulator—a changer of current into currency, than Weeks? Would you have a mathematical demonstrator? See Profs. Carhart, of Ann Arbor, or Badt, of the Western section of the United States company. Ah! you want a general utility man? Scribner covers that every time. Electrical schemers—the woods are full of them from Chicago to Seal Rock, and from Vancouver's to San Diego.

But what your representative started out to mention was the result of a conversation with the Electrical Sorcerer of the West, who is just now with us on a recuperative visit. Professor Edward Tommyson, or better known among his immediate associates and the public also, for that matter, as Ed. Tom-my-son, feeling that to wear out is better than to rust out, is hard at work here, though on a vacation.

Your representative called upon Sorcerer Ed. the other day, in a familiar way, and after a friendly chew out of the newspaper man's individual box, which bears the family arms—two pipes crossant on a mug standant—with the motto, in Norman French, *paix et boucoup*, "peace and plenty." Ed. hung his hat upon the floor, and seating himself on the grindstone, proceeded to be garrulous, like all great wizards and inventors.

"And first," asked the reporter, "what was the nature of the accident which caused that injury to the rim of your hat?"

"Ah!" said he, "that hole has been of a deal of use to me. That is one of the tricks of the trade, sir. No, it was not an accident. Don't give it away. It is useful to watch the shop boss through. A slouch hat with a hole in the rim is of untold value to the ingenious workman."

"Ed, what new inventions are you now working on?"

"Well," counting on his fingers, "I have, let me see. Well, several. There's an electrical hash chopper and fire kindler combined. I have discovered a new form of force, which I am developing direct from the grease bush. The high muck-a-mucks of science are constantly reaching for stars and moons, and neglecting things at their feet. They fire too high.

"Now, I have discovered a principle which is resident in grease bush, and can only be brought out by combustion in combination with a fluid compound in which it has been soaked.

"I prepare the bush, a very small quantity only, and place it in the kitchen stove over night. You have a button on your clock, which is operated by a buzzer. Now, when the time comes in the morning the buzzer goes off, the fire is lighted by a spark, an ethic force is generated, and wired direct to the kitchen table, where the hash is immediately chewed ready for the spider, and the current, proceeding still farther, reaches the independant's window, opens it, and the fresh air flows in. She, being unused to it, is up and around at once. It's a perfect success. Saves so much time."

Rep.—"That is wonderful, certainly."

Ed.—"Yes. I have been calculating the saving of time. Say in a city of 100,000 inhabitants——"

Rep.—"Excuse me. What about your combined electric corn cutter and tooth brush?"

Ed—"I was just going to speak of that. It's the most wonderful of all. How did I come to hit upon it? Well, it was funny. You know I never let up. I am doing something all the time. Even at night, when I am asleep, I snore to fill in time and keep busy.

"Well, I was sitting on the bank of a mill pond, hunting suckers, you know, and there was every sign of rain. My pet corn was aching with an E.M.F. (exasperating me fearfully) an E.M.F. of 'steen hundred volts at least, and a pressure of perhaps twenty amperes, when I looked up and beheld the farmer's daughter, come to call me to a mush and milk lunch. I didn't have my am pere meet her, but as she broke into a regular Wyoming laugh, I saw the worst set of teeth it has ever been my luck to gaze on. A flash came over me like a thought, and the result was a combined corn cutter and tooth brush. I can't put it on the market now till after harvest, for no one cuts green corn, you know."

Your representative gazed in mute astonishment at this man of brains, who, having dropped into moody silence suddenly fell upon the floor, and with a piece of chalk, which he jerked from one of his pockets, commenced an elaborate mathematical problem on the floor, having at least four unknown quantities, if indeed there were any known ones. Your representative was dumfounded and about to leave, when the sorcerer rose to a sitting position, and remarked wildly, "I've got it, I've got it!"

"Got what?" asked the completely disarmed newspaper fiend.

"An electrical trap for clearing out the rats and other night prowling animals of any large city, in combination with the most perfect sewage system known to modern civilization. By this process the watery element of the most noxious sewage is rendered perfectly harmless by a new form of electrolytic action. The hydrogen is carburetted from the residuum, while the oxygen, pure and free as the air on the *mer de glace*, is given off to purify the air we breathe. An attractive perfume is exhaled from the solid portions, and the sewers become the run ways of all the quadrupedal nuisances which infest large cities, and a succession of trap doors permitting movement in but one direction lead these gradually to the outlet, where a monstrous metal tank, filled with a third gas hitherto unknown, asphixiates them, rendering the carcasses innocuous, while at the same time the hairs are removed from the hides, the hides from the bodies, and the bodies from the trap, by a peculiar current generated in a way I cannot yet explain, while the skins take another shute—gravity governs this separation—up to a large glove establish ment run by my thermal motors, which are an improvement on the Indianapolis thermal arrangement, and——"

But your reporter had gone, and left one ear behind him, ragged and bleeding.

Electric Lighting in Maine.

(From a Special Correspondent of the ELECTRICAL REVIEW.)

The Diamon Illuminating Company, composed of Postmaster Manley, of Augusta, and his associates, are placing here a "Sawyer-Man" installation of 1,500 lights capacity, to be enlarged next year. They hope in a year or two to light the whole town. An arc installation will be added, and probably a Thomson-Houston converter system for the outlying districts. Twin Brown-Fitchburg engines will be put in, and a substantial steam plant.

The Brush Company have an installation of several hundred lamps at Ellsworth just west of here.

The Bangor Electric Light Company are using the Thomson-Houston and Sawyer-Man system. The Sawyer-Man Company are also putting in, from the Boston branch, an installation in the Kearsage House, North Conway, N. H. H.

Bar Harbor, Me.

—— The city of Baltimore is now lighted by the electric light at the rate of 50 cents per light per night. There are 487 arc lights used by the city.

Up in a Balloon.

Considerable interest in French politics was once stirred up by an article entitled "Have We a Bourbon Among Us?" published in an American monthly.

"Have we a Jules Verne or a Munchausen among us?" is a proper question now, after Matt. Buell's last paper before the Buffalo Electrical Society, "A Trip into Space," a very interesting piece of readable fiction detailing a startling account of an aerial trip to the moon.

Yet while Buell's pleasantry may for the time being amuse and interest, there is a serious, sober, earnest side to this aerial navigation business worthy of thought and investigation. In Chicago there is to-day an earnest, enthusiastic French scientist who is laboring with fair prospects of eventual success in this direction.

Dr. A. De Bausset, president of the Transcontinental Aerial Navigation Company, says that he is gradually approaching the completion of his plans, and expects shortly to propose to the electricians of the United States a long aerial trip to the North Pole.

The company of which this gentleman is president was incorporated on the 18th of February of last year, with a capital of $150,000. The object of the incorporation being to build aerial vessels, and organize routes over which to transport passengers and mails.

The principles upon which the aeroplane moves and maintains its position are based upon the capacity of the storage or auto-accumulator battery, and the specific gravity of the atmosphere. The vessel, a cylinder with two conical ends, is formed of very thin sheet steel, properly stayed by ribs, bands and longitudinal wires. This cylinder is divided into many air-tight compartments, each of which may be exhausted of its air, and by an unequal distribution of this process the vessel may be inclined and projected at any desired angle, and above or below the horizontal.

The magnitude of the undertaking is what deprives one of breath. The weight of the full sized vessel without its car—654 feet long by 144 feet diameter—is 260,000 pounds. With three-quarters of the air removed from this shell, mathematical calculation demonstrates that there would be an ascensional power of 140 tons of car, engines, dynamos, batteries, mails, and people.

The project is too large to be popular, yet there does not seem to be anything in the least more wonderful than was the telegraph when first announced, or the telephone, which, as all can remember, was jeered and sneered at from the Atlantic to the Pacific, and as generally in the old world.

Mr. E. Colbert, the astronomer and mathematician here, was asked his opinion, and said that as a mathematician he thought it within the limits of possibility, and that the only difficulties in the way are of a mechanical character, like those which attend the efforts to make larger cannon or more powerful telescopes. He thinks it very probable that Dr. De Bousset is on the right track. It has not been possible to controvert the figures of the gentleman, and, as before stated, it is only the immensity of the proposition that staggers the public.

Electric Heating.

The electric light company, of Berlin, announces to its subscribers that from this time forward, current for heating will be furnished.

The apparatus is furnished by the company on conditions of annual installments, and will be added by the subscribers to the conductors.

The current used will be measured in the same manner and paid for at the same price as for lighting.

For the present the company furnishes, amongst others, a machine for heating water, an electric kitchen, and a heater of irons for hair dressers.

—— The Halifax Electric Light Company, Halifax, N. S., have ordered the Jarvis boiler setting for their three boilers.

TELEGRAPHIC

....Since the first of May electric traction has been working regularly on the line of tramways of the Loi à Bruxelles street, Brussels, with complete success.

.....An electrotechnic institute will soon be established at Brussels, and will form an annex to the University. The directors of the new institute will be confided to Professor Rousseau.

... The telephone question will not be settled, it seems, for a few months yet, the U. S. Supreme Court having adjourned for the summer without deciding the cases before it. Meanwhile the infringing companies are not happy.

... Mr. Robt. H. Read, for six years examiner in the electrical and chemical divisions of the U. S. Patent Office, has opened an office at 607 Seventh street, Washington, D. C. He will pay particular attention to soliciting patents for electrical inventors.

.....Copper or brass wire larger than No. 18 is hard to bend. By heating to redness and plunging into cold water both these metals will become much softened. In making joints in wires before soldering, if they are softened in this way and cleaned, excellent contact apart from the solder can be obtained.

....The agreement is made, it seems, between the Belgian and Holland government about the establishment of telephonic communication between Brussels and Amsterdam. As soon as constructed the new line will be connected to the one from Paris, in such a way that Parisians can easily telephone to Amsterdam.

...The *Electrician* asserts that the word microphone was first applied in 1827 to an instrument invented by Wheatstone, and whose object was to be able to hear the most feeble sounds. The word telephone was not used until 1845, the name being given to an apparatus invented by Captain John Taylor for the transmission of signals during foggy weather with the aid of the sounds produced by the passage of compressed air through horns or trumpets.

Kinds of Battery to Use.

The form of cell and kind of solutions employed vary according to the work for which they are used. For some purposes a momentary current is required at considerable intervals of time; and again for others a continuous current of greater or less intensity must be obtained.

Gas lighting apparatus, bells, etc., are in operation a comparatively small part of the time. A battery has a chance to recover—depolarize, as the wise men say. The circuit being in general open, the batteries used are called open circuit, as Leclanche, Permanganate, Law, and all dry batteries.

For intermittent work requiring considerable current, as motors, incandescent lamps, a plunge cell gives good results; carbon and zinc amalgamated with mercury in a solution of sulphuric acid, and bichromate of potash or soda. The zinc must be removed when the cell is not in use, or it will rapidly waste away.

For telegraph lines and closed circuit apparatus in general, requiring a small but constant current, the gravity battery is cheap, economical, and easily managed.

To operate for long periods of time motors or lamps, there is no superior to the porous cup chromic acid cell. The zinc amalgamated is immersed in a solution of sulphuric acid (one part acid to five parts water) containing a few per cent. of bisulphate of mercury. This last keeps the zinc amalgamated, and prevents waste when the battery is not being used. The zinc may, therefore, be left in its solution. The carbon is placed in a solution of sulphuric acid and bichromate of potash or soda—2 lbs. of bichromate, 8 lbs. of acid to 1 gallon of water.

The Baxter Electric Motor.

We illustrate herewith three cuts showing the various styles of stationary motor made by the Baxter Electric Manufacturing and Motor Company. The impression these machines have made when exhibited at the conventions of the National Electric Light Association have been very favorable, and their performance, since they have been put in practical use, has been such as to place them in the very highest ranks, to say the least.

The first of these motors were made of the size required to run sewing machines, small job printing presses, fans, etc., and were wound to run on arc light circuits; the intention of the company from the start, however, has been to manufacture as large sizes as there may be a demand for. They are now making as large as 10 horse power, and are increasing all the time, so that before very long they will be able to supply anything from 50 or 70 horse power down. All sizes from half horse power up are made to run at a constant speed, regardless of whether they are doing much or little work; therefore, they are suited to all kinds of manufacturing purposes, and, in view of their superiority over gas or steam in simplicity, reliability, regularity of motion, cleanliness and convenience, will be used in places where there are electric light companies to furnish the current.

The aim of their inventor has been to produce a machine of the highest possible electrical efficiency, and of faultless design and construction. Mechanically considered, these motors are very perfect. The general appearance is exceedingly attractive, and it is one of the most symmetrically designed electric motors thus far placed upon the market. This is due to the fact that Mr. Baxter, besides being an electrician, is an expert mechanical engineer.

The workmanship of the machine, like the design, is of a very high order. The shafts and all parts subjected to wear are made of cast-steel, hardened and ground perfectly true. The Baxter Company has spent thousands of dollars in making special tools, gigs, gauges, etc., so as to be able to produce the highest grade of interchangeable work. All the various parts are as true as it is possible to make them with the most skillful workmen and the best machinery. While we are not disposed to award the title of superiority to any one, we can say that the Baxter motor is so near theoretical perfection as to leave a very small margin for improvement. Its principal points of excellence are very high electrical efficiency, perfect regulation of speed, entire absence of sparking at the commutator, and extreme simplicity and durability, which are due to the accuracy of workmanship and mechanical perfection of design.

The smallest size, as shown in Fig. 1, is intended to run on arc light circuits only. The power ranges from $\frac{1}{16}$ to $\frac{1}{10}$ horse-power, the difference being effected by winding more or less wire on field magnets. Some of these small motors are made to run sewing machines, and others to run fans, pumps, etc. Those intended for the former service have a movable brush lever that is rotated around the shaft to vary the speed. This does away with the cumbersome resistance box generally used. A spring pulls the lever around in one direction, while a cord attached to a treadle within reach of the operator (the other end being fastened to the extremity of the brush lever) pulls it around in the opposite way, so that by merely pressing on the treadle any desired velocity may be obtained. If the motor is intended to run fans, pumps, or similar duty, when it is not desired to vary the speed, a slight change is made. The brush lever is in such cases constructed so as to be adjustable but not so as to rotate freely around the shaft. The ring, surrounding commutator and brushes, as shown in the cut, is removed, and connection made directly from field coil terminals to brush holders. These miniature motors are about as perfect and complete as it is possible to make a machine of such small dimensions. All that is necessary is to attach the wires, and they are ready to run. They not only contain the means for regulating the speed within themselves, but are also provided with a switch to turn the current on or off, and therefore require no auxiliary attachments of any kind. Their efficiency, considering the size, is very high. The resistance of the field of $\frac{1}{2}$ horse power wound for ten amperes, is 29 ohms, of armature, .05 ohms; electrical energy absorbed by internal resistance $10^2 \times .34 = 34$ watts; power developed in dynamometric tests, 2,840 foot pounds; difference of potential between binding posts a trifle under 10 volts; efficiency, about 64 per cent. There are very few motors as small as this that give more than 25 per cent.

FIG. 1.—THE SMALL BAXTER MOTOR—FOR ARC LIGHT CIRCUITS.

Fig. 2 shows the general appearance of the large sizes of constant current (*i.e.* arc light) motors, as will be seen by inspection of the cut. This machine is very compact and the field exceedingly massive. The energy developed per pound of wire is much greater than any results heretofore obtained. A two horse power motor has but 37 pounds of wire, all told, while a ten horse power has less than 170 pounds and the amount would be still less were it not for the fact that very large diameters are used so as to reduce internal resistance to the lowest point. The armatures are wound with only two layers, but the counter electromotive force is so great in the large machines (6 and 10 horse power) it is in the neighborhood of one volt per foot of wire, and yet the energy expended in magnetizing the field is very small; the number of turns on the armature of a ten horse power motor for ten ampere current is 320. As the counter electromotive force is about 750 volts, it is at the rate of something like $2\frac{1}{3}$ volts per turn. This result surpasses all previous achievements in motors of this size. The system of regulation in the constant current motor is such that it gives the highest efficiency and the most constant velocity. The principle employed is that of changing the strength of field by increasing or decreasing the number of ampere turns, therefore the energy absorbed in magnet coils is reduced much faster than the amount of power developed decreases. Even if the field is magnetized far below saturation, when at the maximum intensity as the armature resistance is extremely low. The result is that these motors will give a somewhat higher electrical efficiency at half than at full load; on this account they are much better adapted to the distribution of energy than if any other system of regulation were used. The practical efficiency of a motor is not what it will show when working up to its full capacity, but is that which obtains when the load is the average of what it does in actual service. To determine the real commercial efficiency the motor should be tested at not over half its maximum capacity. A Baxter constant current motor of 10 horse power under such test, it is stated, will develop an efficiency considerably above 90 per cent.

FIG. 2.—LARGE SIZE ARC LIGHT BAXTER MOTOR.

Although electrical efficiency is of the greatest importance, it is only one of the factors that go toward making up real efficiency. Mechanical perfection and accuracy of action through which simplicity, reliability, and durability are secured is of just as great moment. If a motor is continually getting out of order it will be of little practical value, no matter how high its electrical efficiency may be. One of the principal causes of deterioration is the sparking at the commutator. It is one of the most difficult defects to overcome, and has been the rock upon which many inventors have wrecked. A number of constant potential motors have been made in which it has been overcome, but in this class of machines the problem is a much easier one, owing to the very low E.M.F. used in incandescent systems on which they run. If a motor is required to run under a constant load there should be no difficulty about getting rid of the sparking; it is only when it is put on the test of a variable load that trouble begins, and then it does not reach its height until the high E.M.F. of arc light system has to be contended with.

The arc light system is far more extensively used and therefore is a much more profitable field for motors than the incandescent, and it is on this account that Mr. Baxter devoted himself to the task of making a perfect constant current machine. That he has been entirely successful, is demonstrated by the fact that a large number of Baxter motors are now in daily use, running on Brush and other arc light circuits. We have seen one of these motors in service under the most trying conditions without any visible sparking or change in velocity. It was running a very large machine that absorbed all its power when in motion. When stopped there was no effort required further than that necessary to keep in motion a short countershaft. The conditions therefore were such that the load had to be changed instantly from a maximum to a minimum. Judging from the frequency with which the machine was stopped and started while we were present we concluded that the operation was repeated many hundred times per day. But notwithstanding this severe strain there was not the slightest spark that could be detected by the most careful observation, and no variation in the speed. The bearings were perfectly cool and there was no indication whatever that this unusual strain had any injurious effect upon the machine.

Fig. 3 shows the general appearance of the Baxter constant potential (incandescent) motor. The design is the same as that of the constant current; in fact the same patterns are used in both, but a different system of regulation is used and therefore the governor and its attachments seen in Fig. 2, are removed. The tendency of a constant potential motor, no matter what the winding may be, is to regulate itself. Mr. Baxter makes his constant potential motors, shunt wound. There is no special feature about the winding; it is the simple ordinary shunt devoid of all complications; the perfect regulation is obtained by proper proportions in the various parts.

Although there is not so much difficulty in making a perfect constant potential motor, there are some features about the system which tend to make it very objectionable if not properly guarded against. These are that the current is liable to increase in strength to such an extent as to melt the wire on the armature, and that a motor of a given capacity can develop power far beyond its

limit. This last defect is a very bad one when viewed from a standpoint of the companies engaged in furnishing the current, for a man having a five horse power motor, and paying for that amount of current, could use seven or eight horse power without any difficulty. To overcome this defect as well as that of overheating the wire, Mr. Baxter has devised an automatic cut-out which is supplied with all the motors of this class. When the current becomes too strong from any cause, this cut-out opens the circuit, thus saving the armature from destruction, and at the same time protecting the interests of a lighting or power company, inasmuch as an increase in power beyond the capacity of the machine will cause an increase in current beyond the normal limit. The closeness with which this automatic cut-out can be made to act depends upon the nature of the work done by the motor. If the power is very steady, it can be set to act at a point slightly above the rated capacity.

But if the power is very changeable, and particularly if there are large machines which require considerable effort to set them in motion, it must be set considerably higher. For instance, a four horse power motor used to run a number of sewing machines would have a comparatively steady load, and the cut-out might be set safely at, say, 4½ horse power. But if it were running heavy printing presses, etc., it could not be set closer than about 6 horse power—otherwise it would open the circuit almost every time a press was started. Although this device will protect the interest of the company in almost every case, there is only one real safeguard, where current is supplied to constant potential motors, and that is a current meter.

The efficiency of the Baxter motors is very high; and they are about the same in both systems, ranging from 80 per cent. in the half horse power to over 90 per cent. in the six horse, and even higher than this in the larger sizes. The constant current motors give about the same efficiency under any load from one-third to full capacity; but this is not the case with the constant potential. The maximum result is obtained with full load, and decreases as the work decreases. The difference, however, is not very great, and does not arise from any defect in the design, but is natural to the system, and holds good for any constant potential motor, no matter how constructed, or what the method of regulation may be. In other words, it is not possible to make a machine of this class that will give as high an efficiency with partial as with full load.

In this article we have described these motors in a general way. A more detailed description would require more space than we can allot to the subject at present. In conclusion we will add that their practical performance demonstrates conclusively that electrical science is no longer in the experimental stage, but that it has passed into the field of practicability, and that a thoroughly skillful electrician can design machines that will demonstrate by their actual performance the accuracy of theoretical conclusions.

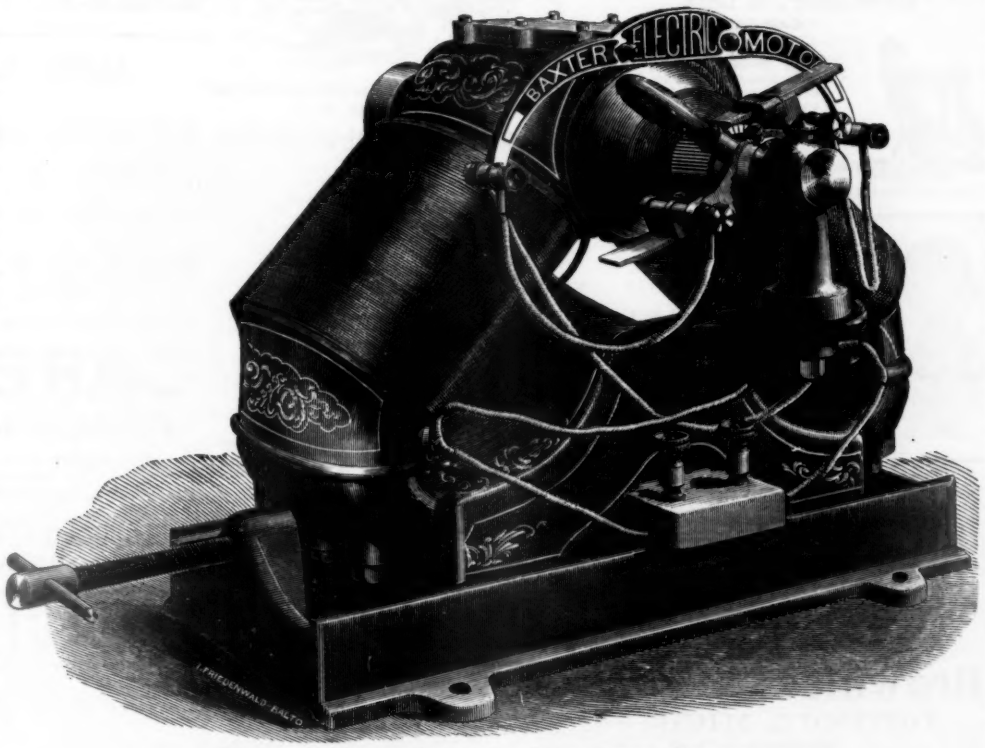

FIG. 3.—THE BAXTER MOTOR FOR INCANDESCENT CIRCUITS.

—— The Providence, R. I., Steam Engine Company, sole builders of the improved Green engine, is building an engine for the Springfield, Mass., Electrical Light Company.

Secondary Generators or Transformers.

London Electrical Review.

We have read with great interest the series of articles by Mr. Rankin Kennedy published in your valuable paper, and will venture to make some remarks about it.

We, of course, cannot pretend to know the intimate thoughts Mr. Kennedy had in 1883; he may already have had at that time clear ideas about the closed magnetic circuit and about the parallel distribution with transformers; but, strangely enough, you will find by reference to the sketch published in your issue of June 16th, 1883, that the induction coil in form of a Gramme ring experimented upon in 1883 by Mr. Kennedy was a two poled one, and not a representant of the closed magnetic circuit principle, as it would appear to your readers after the perusal of the latest publications of the same author.

As to the parallel transformer system, we were the first to emphatically give publicity to its fitness for general distribution of electricity, and we put it to a practical use on a large scale at the Budapest National Exhibition in April, 1885. Nearly 2,000 lamps of 56 volts, at a mean distance of three-quarters of a mile from the generators, were supplied by about a dozen transformers; the primary tension amounted to 1,350 volts. There were Cardew voltmeters with special transformers for reducing the high tension for them; also return test wires from the low tension circuits to the generating station, self-regulation of the generators, and, of course, of the transformers, in fact, nearly all the "latest improvements" since suggested. This plant was in daily work till November, 1885, and a large number of professional men from all parts of the world were shown over all the details of it.

We hope the above cited facts will contribute to clear up ideas about the history of the parallel transformer system and some of the points connected with it.

CH. ZIPERNOWSKI,
MAX DERI,
OTTO T. BLATHY.

Queries and Answers.

To the Editor of Electrical Review:

Will you please tell the undersigned what is meant by "ampere hours"? Will you also explain the watt meter? Does it tell the strength of the current? E.

Chicago, March 31.

ANSWER:—Ten amperes for one hour are counted as ten ampere hours, or one ampere for ten hours, or two amperes for five hours. The number of amperes times the number of hours give the number of ampere hours. A peres for twenty hours. An excessively large rate of discharge cannot be obtained, as the battery has some internal resistance and polarizes in some degree.

The amount of work in moving a water wheel or other motor, done by water, depends on the amount of water and the pressure. In the same way the amount of work done by an electric current depends on the amount (measured in amperes) and the pressure (called electromotive force, measured in volts). One ampere at one volt pressure is called a watt. The work done in lighting or in setting motor in motion is measured in watts, and is equal to the current in amperes times the electromotive force or pressure in volts. A watt meter will not give the strength of the current, but the product of that strength times the number of volts. To obtain the current strength use a tangent galvanometer, or one one of the ammeters in common use.

To the Editor of Electrical Review:

I intend to make an induction coil, 9 inches in length, with two layers of No. 16 copper wire for the primary coil, and have the secondary coil wound with No. 36 cotton-covered wire.

1. How should I insulate the layers of the secondary coil from each other? I would prefer not to varnish the layers.

2. About how large a spark will the coil give with a 50 square foot condenser, and how large without a condenser?

3. I have a small magneto-machine, such as is used for telephone calls; it will magnetize a magnet wound with fine wire, but will not magnetize one wound with No. 16 or 20 wire.

4. How can I make it magnetize the magnets wound with No. 16 wire?

Davenport, Ia. L. L. R.

ANSWER.—1. Divide the winding of the secondary into sections, as described on page 290, Jenkin, Electricity and Magnetism. The sections should be separated from the primary by a hard rubber tube, and the sections from each other by leatheroid sheets. In winding each section, separate the layers by paraffined paper or silk.

2. The size of the spark would depend upon the length of wire you wind on your secondary, and upon the amount of current you employ in the primary.

3. The resistance of the armature is high. The current generated is small, and does not magnetize noticeable the No. 16 wire magnet, because there are enough turns on the core. The greatest output can be obtained from an electric generator when the external resistance is equal to the resistance of the generator. The resistance of the fine wire coil is probably nearly that of the machine.

4. Put in a new armature wound with No. 18 or any coarse wire.

ELECTRIC LIGHT NEWS

—— The City of Akron, Ohio, will have the electric lights, driven by the Ball engine.

—— Savannah, Ga., is to be lighted by the Brush Electric Light, the steam plant being furnished by the Ball Engine Company, of Erie, Pa.

—— Shenandoah, Pa., has fallen into line, and will soon have her streets lighted with electric lights. The dynamos are driven by two 10x12 Ball engines.

—— A new plant for the Gas and Electric Light Company, of San Diego, Cal., has arrived in that city. It is six times the capacity of the plant now in use.

—— The Brush Electric Light Company, Savannah, are setting a new tubular boiler with the Jarvis patent boiler setting. They will burn wet rice chaff and cotton-seed hulls for fuel.

—— The Electric Light Company, of Atlantic City, have contracted with the American Electric Manufacturing Company for a 50-light plant, which will be put in at once.

—— The Colorado Electric Light Company, Denver, Col., have ordered four Heine sectional safety boilers, and will set them with the Jarvis patent boiler setting to burn lignite coal.

—— The Thomson-Houston Electric Company have just closed a contract at Winston, N. C., which will be lighted with their lights, the steam plant being furnished by the Ball Engine Company, of Erie, Pa.

—— At San Jose, Cal., an electric railway company has been granted a franchise by the Council to operate a double track road on Santa Clara street, to be commenced in 60 days and finished in six months.

—— The address of the general European office of the Thomson-Houston International Electric Company has been changed to Michaelisbrucke, Hamburg, Germany. The telegraphic and cable address will be "Cut-out." Mr. James F. Meech is in charge of this office, and is doing an extensive electric lighting business.

—— An electric railway is in course of construction at Richmond, Va. It is to be eleven miles long, which is, we believe, the greatest length yet constructed for electric power. It is the intention of the promotors to not only have the cars run by electricity, but also lighted and heated by the same element. The electric heater of Dr. W. Leigh Burton will be used, and will form part of the circuit, to be switched in or out, as occasion will require. This will be a new departure in electric work, and will be watched with interest, and if successful, as Dr. Burton believes it will be, will mark another step in the onward march of electricity.

——The insurance companies have taken a stand against the use of braided, lead painted wire in damp or concealed places. The incandescent companies attributing little troubles in the working of their systems to poor insulation are willing as a rule to conform to regulations of the insurance inspectors. There are inexperienced persons in the electric light field, who, to get work, make bids at a lower figure than first-class work requires. Cheap insulation is used, wires are tacked to walls and ceilings, joints are poorly soldered and insulated. The very small amount of damage resulting from such defective work proves the perfect safety of electric system of lighting when properly installed. Suppose an arc circuit is in contact with many trees, after a short rain, the wire may be grounded to some extent through spongy insulation on both the positive and negative wire near the dynamo. The two grounds form a shunt over the rest of the circuit. Is it strange that the distant lamps burn dim, and the electric light company receive no credit for heating the earth with the current the arc lamps do not get? No less in electric gas lighting and annunciator plants is there need of waterproof, or at least damp-proof wire, if good satisfaction is desired. A leak on such circuits, though small, is constantly weakening the battery.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING MAY 31, 1887.

363,880 Device for preventing the escape of noxious fumes from batteries; Mark Bailey and John Warner, London, England.

363,886 Electric belt; Wilson W. Dunlap, Oskaloosa, Iowa.

363,969 Multiple telegraph system; Charles Selden, Baltimore, Md., assignor to himself, William T. Barnard, same place, and Francois Van Ryssel berghe, Brussels, Belgium.

364,081 Method of carbonizing incandescents; William Maxwell, Claybrook road, Fulham, county of Middlesex, England.

364,133 Desk for telephone; John D. Richardson Brooklyn, assignor to the Commercial Patent Development Company, New York, N. Y.

364,177 Machine for making seamless, lead-covered electrical conductors; George L. Kitson Philadelphia, Pa., assignor, by direct and mesne assignments, to the Kitson Electric Company, Camden, N. J.

364,178 Lead-covered electrical conductor or cable; George L. Kitson, Philadelphia, Pa., assignor, by direct and mesne assignments, to the Kitson Electric Company, Camden, N. J.

10,838 Electrical safety device for elevator; Robert M. Curtis, Brooklyn, N. Y.

THE AMERICAN ELECTRICAL WORKS.

The American Electrical Works, of Providence, R. I., have removed their N. Y. office from 15 Cortlandt st. to the Metropolitan Telephone Co. building, 18 Cortlandt st., where they will carry a line of their staple goods of Telephone, Telegraph and Electric Light Insulated Wires.

Mr. P. C. Ackerman will have charge of their business, vice Harry Hall, resigned, who will be pleased to see all of their old customers. Any one in want of Insulated Wire in any form will find it to their interest to call.

BUSINESS NOTICE.

"In making the statements which follow we can verify each and all of them as facts. Mr. Edward P. Thompson, of Temple Court (7 Beekman St.,) New York, is a good man to bring your patent cases to, for he is thoroughly versed in all the ins and outs of a Patent Attorney's duties. The following are some of his qualifications: Graduate of Stevens Institute as Mechanical Engineer. For four years tutor of classes of young men in mathematics and experimental physics at Elizabeth, N. J. Served professionally as Electrician and Chemist in the Swan Electric Company of New York for two years. Because of past successes as a Patent Attorney at 13 Park Row, New York, was appointed, to succeed N. S. Keith, of the patent agency of the *Electrical World* and Associate Editor. N. S. Keith is known as the Translator and Reviser of Schellen's Treatise on "Dynamo Electric Machinery." Mr. Thompson for two years personally prepared and prosecuted all the patent business of *Electrical World's* Patent Agency, and is the author of a series of articles in said paper upon "Analytical and Systematic Method of Inventing," which were widely known and favorably received. Mr. Thompson is a member of American Institute of Electrical Engineers and American Society of Mechanical Engineers. He is author of the "Expansion of Polynomials," which the ablest mathematicians of the world universally commend." —*New York Observer*.

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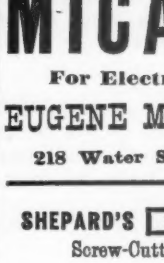

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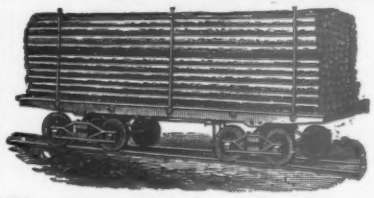

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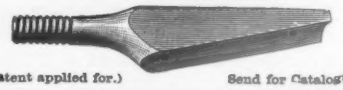

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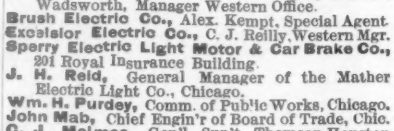

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